CLAIMS

1. A fuel cell system having a fuel cell stack formed by stacking a plurality of fuel cells for generating power through an electrochemical reaction utilizing reactant gas, wherein

an operation mode of the fuel cell stack is determined based on a voltage rising condition of the fuel cell stack that is detected after supply of the reactant gas is started.

2. A fuel cell system having a fuel cell stack formed by stacking a plurality of fuel cells for generating power through an electrochemical reaction utilizing reactant gas; comprising:

voltage rising detection means for detecting a voltage rising condition of the fuel cell stack after supply of the reactant gas is started; and

control means for determining an operation mode in accordance with the voltage rising condition detected by the voltage rising detection means and operating the fuel cell stack in the determined operation mode.

3. A fuel cell system having a fuel cell stack formed by stacking a plurality of fuel cells for generating power through an electrochemical reaction utilizing reactant gas; comprising:

voltage rising detector for detecting a voltage rising condition of the fuel cell stack after supply of the reactant gas is started; and

control unit for determining an operation mode in accordance with the voltage rising condition detected by the voltage rising detector and operating the fuel cell stack in the determined operation mode.

4. The fuel cell system according to claim 3, wherein the voltage rising detector determines the voltage rising condition by determining whether a differential coefficient of a voltage value of the fuel cell stack with respect to time is positive or negative.

5. The fuel cell system according to claim 3, wherein the voltage rising detector

determines the voltage rising condition by determining whether or not a voltage value detected after a predetermined time period has elapsed from starting the supply of the reactant gas exceeds predetermined threshold value.

6. The fuel cell system according to any one of claims 3 to 5, wherein the control unit varies a value of load current obtained from the fuel cell stack in accordance with the voltage rising condition detected by the voltage rising detector.

7. The fuel cell system according to claim 6, wherein the control unit reduces the value of load current obtained from the fuel cell stack to less than that for a normal operation when the differential coefficient is positive.

8. The fuel cell system according to claim 6, wherein the control unit reduces the value of load current obtained from the fuel cell stack to less than that for the normal operation when the voltage value detected after the elapse of the predetermined time period does not exceed the threshold value.

9. The fuel cell system according to any one of claims 3 to 5, further comprising:
stack heating unit for heating the fuel cell stack, wherein
the control unit varies a heating value of the stack heating unit in accordance with the voltage rising condition detected by the voltage rising detector.

10. The fuel cell system according to claim 9, wherein the control unit increases the heating value of the stack heating unit to more than that for the normal operation when the differential coefficient is positive.

11. The fuel cell system according to claim 9, wherein the control unit increases the heating value of the stack heating unit to more than that for the normal operation when the

voltage value detected after the elapse of the predetermined time period does not exceed the threshold value.

12. The fuel cell system according to any one of claims 3 to 5, further comprising:

reactant gas flow rate control unit for controlling a flow rate of the reactant gas supplied to the fuel cell stack, wherein

the control unit varies the flow rate of the reactant gas supplied to the fuel cell stack by controlling the reactant gas flow rate control unit, in accordance with the voltage rising condition detected by the voltage rising detector.

13. The fuel cell system according to claim 12, wherein the control unit increases the flow rate of the reactant gas to more than that for the normal operation when the differential coefficient is positive.

14. The fuel cell system according to claim 12, wherein the control unit increases the flow rate of the reactant gas to more than that for the normal operation when the voltage value detected after the elapse of the predetermined time period does not exceed the threshold value.

15. The fuel cell system according to any one of claims 3 to 5, further comprising:

circulatory unit for circulating a heating medium through the fuel cell stack, wherein

the control unit varies a flow rate of the heating medium in accordance with the voltage rising condition detected by the voltage rising detector.

16. The fuel cell system according to claim 15, wherein the control unit increases the flow rate of the heating medium to more than that for the normal operation when the differential coefficient is positive.

17. The fuel cell system according to claim 15, wherein the control unit increases the flow

rate of the heating medium to more than that for the normal operation when the voltage value detected after the elapse of the predetermined time period does not exceed the threshold value.

18. The fuel cell system according to any one of claims 3 to 5, further comprising:

circulatory unit for circulating a heating medium through the fuel cell stack; and

medium heating unit for heating the heating medium, wherein

the control unit varies temperature of the heating medium in accordance with the voltage rising condition detected by the voltage rising detector.

19. The fuel cell system according to claim 18, wherein the control unit raises the temperature of the heating medium to higher than that for the normal operation when the differential coefficient is positive.

20. The fuel cell system according to claim 18, wherein the control unit raises the temperature of the heating medium to higher than that for the normal operation when the voltage value detected after the elapse of the predetermined time period does not exceed the threshold value.

21. The fuel cell system according to any one of claims 3 to 5, further comprising:

reactant gas pressure control unit for controlling pressure of the reactant gas supplied to the fuel cell stack, wherein

the control unit varies pressure of the reactant gas supplied to the fuel cell stack by controlling the reactant gas pressure control unit, in accordance with the voltage rising condition detected by the voltage rising detector.

22. The fuel cell system according to claim 21, wherein the control unit increases the pressure of the reactant gas to higher than that for the normal operation when the differential coefficient is positive.

23. The fuel cell system according to claim 21, wherein the control unit increases the pressure of the reactant gas to higher than that for the normal operation when the voltage value detected after the elapse of the predetermined time period does not exceed the threshold value.

24. The fuel cell system according to any one of claims 3 to 23, wherein the voltage rising detector detects the voltage rising condition by measuring voltages or an average thereof, of at least a set of fuel cells placed near the ends of the fuel cell stack.

25. The fuel cell system according to any of claims 3 to 24, wherein, upon starting the fuel cell stack below freezing, the control unit determines the operation mode of the fuel cell stack in accordance with the voltage rising condition detected by the voltage rising detector and operates the fuel cell stack in the determined operation mode.